

Preface

An essential ingredient in the movement of large amounts of data on worldwide digital networks is agreement on and computer support for internationally recognized architectures for broadband communications services. IBM has contributed to the development of international standards for asynchronous transfer mode (ATM), which underlies much of the effort to produce systems for broadband computer communications and digital networks. IBM's high-speed, multimedia networking architecture and products, based on the ATM architecture, are known by the term Networking BroadBand Services (NBBS) and fit under the umbrella of IBM's Open Blueprint*.

This issue contains an introductory essay on ATM and NBBS and ten papers on the NBBS approach, architecture, technologies, and products. In combination with the previous issue of the *Journal* on network technologies and systems, this issue shows the direction IBM has taken in delivering architecture, systems, and products for worldwide digital communications. We are indebted to M. R. Wiggins of the IBM Networking Hardware Division in Research Triangle Park, North Carolina, for his contributions to the creation, development, and preparation of this issue.

The development of high-performance networks is driven by demand for high levels of network integration, transparent connectivity, high capacity, high speed, and lower costs. Cohen and Abensour, in an introductory essay, discuss those needs, describe the ATM architecture as a response to those needs, and present IBM's strategy for fulfilling the ATM architectural requirements.

Marin et al. provide an extensive overview of IBM's approach for satisfying both the ATM architecture and, more generally, the demand for high-performance networks. That approach is embodied in the Networking BroadBand Services (NBBS) architecture and its technologies and components. During the course of this overview, attention is given to

quality-of-service guarantees, efficient handling of diverse network traffic at gigabit speeds, network throughput, and multicasting capabilities.

Applications such as video on demand, software distribution, and videoconferencing require multicasting—broadcasting limited to a known set of recipients. As Budhiraja et al. show in their paper, multicasting requires an architecture and protocols that support definition and control of the set of recipients and provide high-speed and high-quality network connections. NBBS contains a multicast architecture that meets these requirements, for which the authors supply an overview.

Ahmadi et al. discuss a further aspect of networks in general and ATM networks in particular: traffic management. Included in this broad term are such important and fundamental tasks as path selection, bandwidth allocation, administration of service guarantees, and various other connection-, packet-, and cell-level controls. In this paper the authors describe the associated NBBS features and their interaction.

Selection of network paths and links for high-speed and, notably, multimedia applications with quality-of-service guarantees and constraints is the subject of a paper by Tedijanto et al. Since the resulting selection is a nonpolynomial- (NP-) complete problem, the authors describe their heuristic algorithm for determining an effective path. The algorithm has features such as connection and preemption priorities and the use of primary and secondary paths.

Network control protocols have traditionally assumed relatively slow and error-prone networks. Today's high-speed and reliable networks are more effectively served by protocols that take advantage of those characteristics. Peyravian et al., in their paper, present their work on the new Rapid Transport Protocol, designed to provide fast and effective distributed network control for point-to-point

and multicast communications and in use as part of NBBS.

Immanuel et al. describe the impact of the many current network protocols on the ability of networks to operate effectively. In NBBS the solution to this technical issue resides in the access services of the NBBS transport functions, using the model of access agents that exploit NBBS features to effectively deal with multiple network protocols, while shielding users from detailed knowledge of how this is accomplished. The authors demonstrate their approach through examples of access agents.

Onvural et al. present two challenges to the effective utilization of the ATM architecture and its technologies: the development of network control services meeting ATM standards without performance degradation, and efficient implementation of the ATM standards themselves. The authors give the current status of the standards, discuss the NBBS response, and describe efficient implementations of the standards in NBBS.

In order to control and limit the network complexity visible at each node of an NBBS network, the notion of an NBBS access node has been developed. Unlike an intermediate node, an access node can only operate at the edge of the network map and can therefore effectively minimize its knowledge and support of the rest of the network, without detracting from the size or effectiveness of the network as a whole. Budhiraja et al. present the NBBS access node and describe its architecture and function.

High-speed switching is a critical part of broadcast networking. Lebizay et al. describe the architecture and technology of the IBM transport network node and explain how it supports the NBBS architecture. The transport node platform uses switching technology designed to avoid congestion and prevent loss of data. The technology used for the switch's input and output modular adapters allows them to be configured for port, trunk, server, or control functions. The authors show the effectiveness of the technology by showing hardware and software performance figures.

Modern networks necessarily contain extensive capabilities for network management, and NBBS is no exception. The paper by Owen describes the overall NBBS approach and a number of specific functions in the course of discussing such concerns

as network operation, use, accounting, topology, performance, names, and fault management. Owen's work incorporates the Common Management Information Protocol (CMIP) and the Simple Network Management Protocol (SNMP) standards.

The next issue of the Journal will present papers on medical imaging, IBM's Information Framework, Resource Access Control Facility (RACF*), and other topics.

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Editor

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